the bumper case 14 and the substrate 11. Even in this assembly, the semiconductor element 1' is allowed to be deformed, and has the same advantages as those described in the embodiment 1 and embodiment 2.

Further, as shown in Fig. 9B, the semiconductor element 1' of the semiconductor device 15 has the top surface and the border entirely sealed after being mounted in the present embodiment. Therefore, the device 15 and electrodes 12 have has junctions prevented from moisture and extraneous matter entering the junctions, and thus, has an improved reliability after the mounting.

(Exemplary Embodiment 4)

Fig. 10A through Fig. 10D and Fig. 11A through Fig. 11C illustrate processes in a method of manufacturing a semiconductor device in accordance with an exemplary embodiment 4 of the present invention. Fig. 12 is a perspective view of the semiconductor device. Fig. 13A through Fig. 13C illustrate processes of mounting the device. Fig. 10A through Fig. 10D and Fig. 11A through Fig. 11C illustrate the method of mounting the device in order of procedure of the method.

In Fig. 10A, bumps 2, electrodes for external connections, are formed on a top surface of a semiconductor wafer 1 including plural semiconductor elements formed therein. As shown in Fig. 10B, a sheet 3 is attached to a bump-formed surface (electrode-formed surface), which is the top surface of the wafer 1. And the wafer 1, upon being reinforced with the sheet 3, has a back surface opposite to the electrode-formed surface thinned. The wafer 1 may be thinned by shaving with a polishing machine having a grinding wheel, by etching with a dry etching apparatus, or by etching utilizing a chemical reaction of a chemical solution. The wafer 1 is thus thinned to a thickness of

about 50μm.

Subsequently, a bumper plate 4 is stuck to the back surface of the thinned semiconductor wafer 1. As shown in Fig. 10C, an adhesive 50 is applied on a top surface of bumper plate 4 at each portion corresponding to each semiconductor element of the wafer 1. The bumper plate 4 is formed by shaping a material such as resin, ceramic, metal or the like into a plate. In Fig. 10C, the adhesive 50 is applied to only a portion corresponding to a center of each semiconductor element. The adhesive 50 is made of resin having an elastic modulus lower than the bumper plate 4.

The bumper plate 4 functions as a holding member in handling of the semiconductor device after the semiconductor elements are separated from one another to form the semiconductor devices, respectively, and also functions as a bumper to protect the semiconductor elements from external force and impact. Accordingly, the bumper plate 4 has an enough thickness to exhibit greater flexural rigidity than the semiconductor element. After the bumper plate 4 is applied to the wafer 1, as shown in Fig. 10D, a reinforcing sheet 6 used for a dicing process is applied to an undersurface of the bumper plate 4, and then, the sheet 3 is peeled from the electrode-formed surface.

The bumper plate 4 and semiconductor wafer 1 both reinforced with the sheet 6 then is subjected to the dicing process. In the process, as shown in Fig. 11A, two-stage dicing is performed to cut the bumper plate 4 and wafer 1 with different dicing widths, respectively. Specifically, the wafer 1 is cut with a dicing width b1 and divided into discrete semiconductor elements 1', while bumper plate 4 is cut with a dicing width b2 narrower than the width b1 and divided into discrete bumper members 4'.

The sheet 6 is then peeled from the bumper members 4' bonded to respective semiconductor elements 1' with the adhesive 50, and consequently,

discrete semiconductor devices 30 are provided, similarly to Fig. 11B. Each device 30 includes the semiconductor element 1' having the bumps 2 functioning as electrodes for external connections, and the bumper member 4 functioning as a holding member during the handling. The holding member is bonded to the back surface opposite to the electrode-formed surface of the element 1' with the adhesive 50. A size B2 of the bumper member 4 is larger than a size B1 of the semiconductor element 1', and therefore, an outer edge of the bumper member 4 protrudes more outward than a outer edge of the element 1'. Only the center of semiconductor element 1' is bonded to the corresponding portion of the bumper member 4 with the adhesive 50. The semiconductor device 30, since having an outer border of the semiconductor element 1' free against the bumper member 4, is resistant to warping even if the element 1' and bumper member 4 has the sizes change due to thermal expansion.

As shown in Fig. 12, the bumper member 4 may include a part code 8 as identification information printed on a top surface thereof and a polarity mark 9 indicative of a mounting direction printed at a corner thereof similarly to a conventional resin-sealed electronic component. In other words, a reverse surface, positioned opposite to a junction of the bumper member 4' and semiconductor element 1', of bumper member 4 is a surface to which the identification information is applied. Then, the discrete semiconductor device 30 is inverted to have the bumper members 4 face upward, and then, is subjected to a taping process to hold the device with a tape for supplying electronic components. Thus, the device 30 can be mounted with an electronic component mounting apparatus.

instead of the semiconductor element 1', a dummy semiconductor device made of a silicon plate having a thickness of 50μm was subjected to a